Examination of potential protein crystallization method via molecular self assembly

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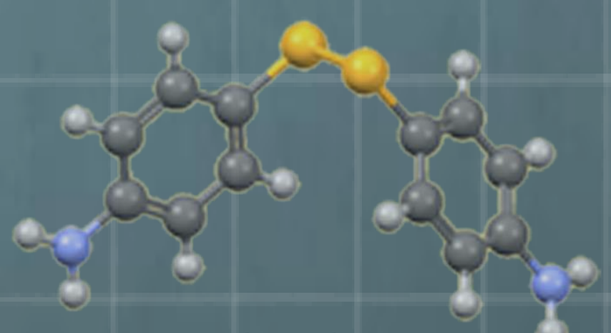
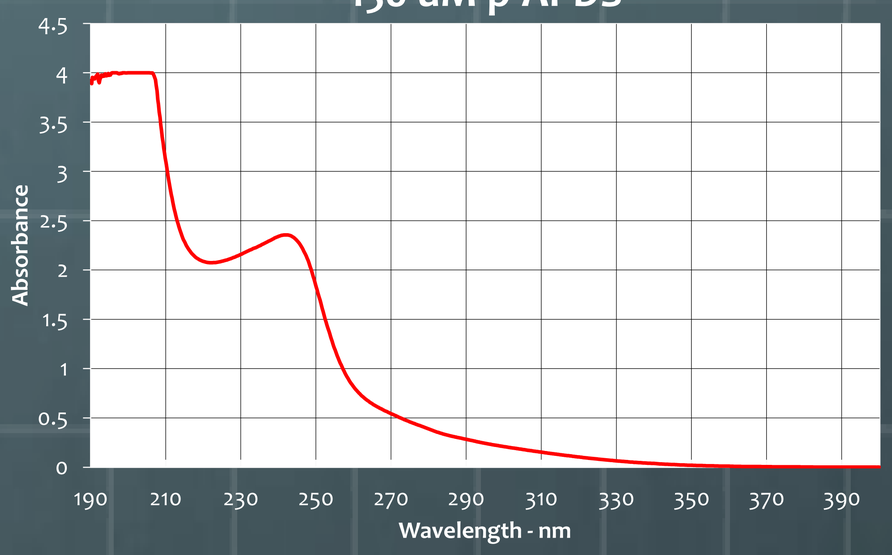
Hypothesis

The molecular self assembly phenomenon demonstrated by p-aminophenyl disulfide (p-APDS) in water could be applied to protein solutions as a possible new and robust method of creating viable protein crystals[1]. These crystals are used for determining ribbon structure through X-ray crystallography.[2]



p-APDS molecular structure

Absorbance spectrum 150 uM p-APDS



Objectives

-Investigation into optimal conditions for protein crystal growth during self-assembly

-Test for enzyme catalytic activity in p-ATP/protein structure.

Methods

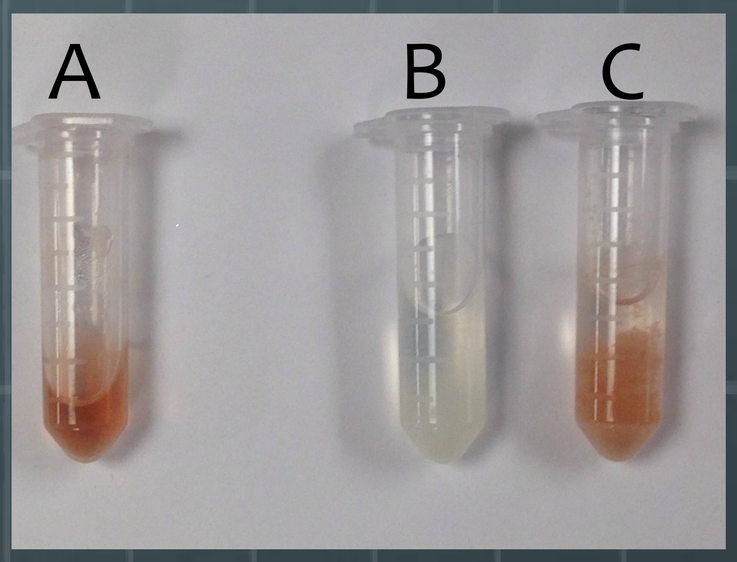
-Optimal growing conditions evaluated microscopically

-Catalytic activity tested both visually through positive color changes and via spectrophotometry

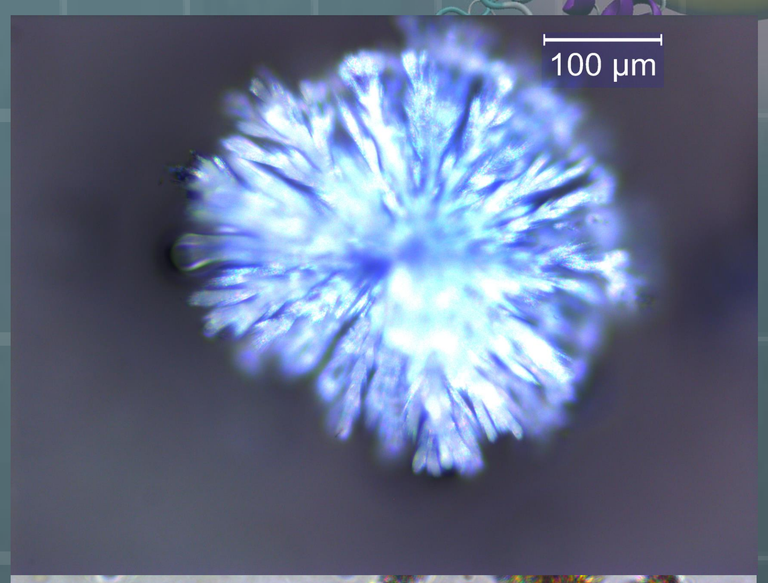
Results

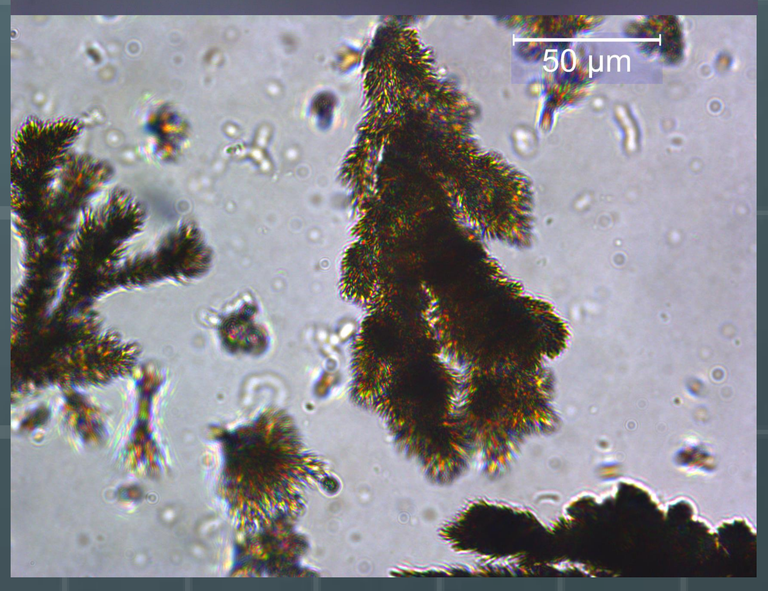
-Self assembly carried out at the pH of a protein's isoelectric point produced the most unique structures

-No immediate enzymatic activity, but positive evidence of activity was seen after 12 days.



A: Color change of a positive control.
B. Laccase crystals before susbtrate added
C: Laccase crystals 12 days after substrate added





Structures seen in lysozyme crystallization (top) and Immunoglobin-G crystallization (bottom)

Conclusion

-Evidence of limited activity implies proteins keep some shape in p-APDS lattice

-Knowledge of optimum growth pH allows for further investigation on enzymatic activity/recognition.

-Further research needs to be done towards producing viable crystals for crystallography and other applications.

References

1. Abbas, Abdennour, Andrew Brimer, Limei Tian, D. A. D'Avignon, Abdulrahman Shahul Hameed, Jagadese J. Vital, and Srikanth Singamaneni. "Vesicle-Mediated Growth of Tubular Branches and Centimeter-Long Microtubes from a Single Molecule." *Wiley Online Library*. Small, 12 Aug. 2013. Web. 7 Oct. 2013. <http://onlinelibrary.wiley.com/doi/10.1002/smll.201202509/abstract>.

2. Lawson, Dave. "Summary of Protein Crystallography." *Summary of Protein Crystallography*. John Innes Centre, n.d. Web. 07 Oct. 2013. <http://www.jic.ac.uk/staff/david-lawson/xtallog/summary.htm>.

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